

**What is claimed is:**

1. A sporicidal composition prepared by mixing ingredients comprising:
  - (a) a mono-carboxylic acid;
  - (b) a non-ionic peroxide or its conjugate base;
  - (c) a salt of an inorganic mono-peroxy acid; and
  - (d) an aqueous acidic solution or suspension to adjust the pH of the sporicidal composition to a value of from about 0.5 to about 3.0.
2. The sporicidal composition of claim 1, wherein the mono-carboxylic acid comprises:
  - (a) a carboxylic acid of general formula  $R-CO_2H$ , wherein R is a straight-chain or branched-chain saturated alkyl group  $C_nH_{2n+1}$ , wherein  $0 \leq n \leq 9$ ;
  - (b) a ketoacid of general formula  $R-COCO_2H$ , wherein R is a straight-chain or branched-chain saturated alkyl group  $C_nH_{2n+1}$ , wherein  $0 \leq n \leq 6$ ;
  - (c) a half ester of a dicarboxylic acid of general formula  $R-OCO(CH_2)_xCO_2H$ , wherein  $0 \leq x \leq 6$ , and wherein R is a straight-chain or branched-chain saturated alkyl group  $C_nH_{2n+1}$ , wherein  $0 \leq n \leq 4$ ; or
  - (d) a mixture thereof.
3. The sporicidal composition of claim 2, wherein the carboxylic acid of general formula  $R-CO_2H$  comprises butyric acid, octanoic acid, propanoic acid, or a mixture thereof.
4. The sporicidal composition of claim 2, wherein the ketoacid of general formula  $R-COCO_2H$  comprises pyruvic acid.
5. The sporicidal composition of claim 2, wherein the ketoacid of general formula  $R-COCO_2H$  comprises oxaloacetic acid.
6. The sporicidal composition of claim 2, wherein the a half ester of a dicarboxylic acid of general formula  $R-OCO(CH_2)_xCO_2H$  comprises monoethyl succinate, monoethyl glutarate, or a mixture thereof.

7. The sporicidal composition of claim 1, wherein the non-ionic peroxide or its conjugate base comprises hydrogen peroxide, *tert*-butyl hydroperoxide, benzoyl peroxide, or a mixture thereof.

8. The sporicidal composition of claim 1, wherein the salt of an inorganic mono-peroxy acid comprises a alkali metal salt of peroxymonosulfate, persulfate, perborate, peroxymonophosphate, or a mixture thereof.

9. The sporicidal composition of claim 1, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes ("AGIIS"), a highly acidic metalated organic acid ("HAMO"), a highly acidic metalated mixture of inorganic acids ("HAMMIA"), or a mixture thereof.

10. The sporicidal composition of claim 1, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes ("AGIIS"), sulfuric acid, hydrochloric acid, phosphoric acid, sulfonic acid, or a mixture thereof.

11. The sporicidal composition of claim 1, wherein the pH ranges from about 0.5 to about 2.0.

12. A sporicidal composition prepared by mixing ingredients comprising:
- (a) a mono-carboxylic acid of:
    - (i) a carboxylic acid of general formula  $R\text{-CO}_2\text{H}$ , wherein R is a straight-chain or branched-chain saturated alkyl group  $\text{C}_n\text{H}_{2n+1}$ , wherein  $0 \leq n \leq 9$ ;
    - (ii) a ketoacid of general formula  $R\text{-COCO}_2\text{H}$ , wherein R is a straight-chain or branched-chain saturated alkyl group  $\text{C}_n\text{H}_{2n+1}$ , wherein  $0 \leq n \leq 6$ ;
    - (iii) a half ester of a dicarboxylic acid of general formula  $R\text{-OCO}(\text{CH}_2)_x\text{CO}_2\text{H}$ , wherein  $0 \leq x \leq 6$ , and wherein R is a straight-chain or branched-chain saturated alkyl group  $\text{C}_n\text{H}_{2n+1}$ , wherein  $0 \leq n \leq 4$ ; or
    - (iv) a mixture thereof;
  - (b) a non-ionic peroxide or its conjugate base;
  - (c) a salt of an inorganic mono-peroxy acid; and
  - (d) an aqueous acidic solution or suspension to adjust the pH of the sporicidal composition to a value of from about 0.5 to about 3.0.
13. The sporicidal composition of claim 12, wherein the carboxylic acid of general formula  $R\text{-CO}_2\text{H}$  comprises butyric acid, octanoic acid, propanoic acid, or a mixture thereof.
14. The sporicidal composition of claim 12, wherein the ketoacid of general formula  $R\text{-COCO}_2\text{H}$  comprises pyruvic acid.
15. The sporicidal composition of claim 12, wherein the ketoacid of general formula  $R\text{-COCO}_2\text{H}$  comprises oxaloacetic acid.
16. The sporicidal composition of claim 12, wherein the a half ester of a dicarboxylic acid of general formula  $R\text{-OCO}(\text{CH}_2)_x\text{CO}_2\text{H}$  comprises monoethyl succinate, monoethyl glutarate, or a mixture thereof.

17. The sporicidal composition of claim 12, wherein the non-ionic peroxide or its conjugate base comprises hydrogen peroxide, *tert*-butyl hydroperoxide, benzoyl peroxide, or a mixture thereof.

18. The sporicidal composition of claim 12, wherein the salt of an inorganic mono-peroxy acid comprises an alkali metal salt of peroxymonosulfate, persulfate, perborate, peroxymonophosphate, or a mixture thereof.

19. The sporicidal composition of claim 12, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes ("AGIIS"), a highly acidic metalated organic acid ("HAMO"), a highly acidic metalated mixture of inorganic acids ("HAMMIA"), or a mixture thereof.

20. The sporicidal composition of claim 12, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes ("AGIIS"), sulfuric acid, hydrochloric acid, phosphoric acid, sulfonic acid, or a mixture thereof.

21. The sporicidal composition of claim 12, wherein the pH ranges from about 0.5 to about 2.0.

22. A sporicidal composition prepared by mixing ingredients comprising:
- (a) butyric acid;
  - (b) hydrogen peroxide;
  - (c) alkali metal salt of monopersulfate; and
  - (d) an aqueous acidic solution or suspension to adjust the pH of the sporicidal composition to a value of from about 0.5 to about 3.0.
23. The sporicidal composition of claim 22, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes (“AGIIS”), a highly acidic metalated organic acid (“HAMO”), a highly acidic metalated mixture of inorganic acids (“HAMMIA”), or a mixture thereof.
24. The sporicidal composition of claim 22, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes (“AGIIS”).
25. The sporicidal composition of claim 23, wherein the aqueous acidic solution or suspension comprises an acidic solution of sparingly-soluble Group IIA complexes (“AGIIS”), sulfuric acid, hydrochloric acid, phosphoric acid, sulfonic acid, or a mixture thereof.
26. The sporicidal composition of claim 23, wherein the pH ranges from about 0.5 to about 2.0.